SECTION A - INTRODUCTION

This design manual contains procedure, design aids, standard details and drawings, useful for developing construction drawings for gated outlets and appurtenances common to earth dams used for storage of water for irrigation.

As the cover graphically indicates, the planner needs only the basic data to enter this guide and come out with essentially the completed drawings for the outlet appurtenances.

Design aids in the form of nomographs, charts and tables have been developed wherever possible to provide ready solution of design analyses. Examples have been placed on each of the more complex charts and nomographs to facilitate their use and help the designer grasp the relationship between dependent variables in identifying most alternatives.

Some of the figures may appear complicated and require some study of the example to understand the relationships expressed. Once master of a chart, the designer has a comprehensive understanding and perspective of the relationship between elements attainable in no other way.

Each section of the manual is presented in adequate detail for treatment of its specific subject in design of small irrigation storage structures. An example is continued through the manual. As each section is finished, the progressive example is completed to include the system components discussed in that section.

The hydraulics section is a general treatment of hydraulic design of gated outlet systems. It is in adequate detail for preliminary design purposes and in many cases satisfactory for final design. Refined analysis is recommended where critical design factors and cost alternatives are involved.

Discussion of hydraulic systems for operation of control gates on earth dam conduits is presented in detail since the application is somewhat unique. The hydraulic system offers advantages under certain conditions over the mechanical gate stem control that makes it worth consideration.

The importance of proper conduit design and installation cannot be overstressed to insure safety of the structure. It is usually impractical if not impossible to repair deficiencies in conduits through embankments; this unit of the system must be done right the first time. Every item presented in this section deserves careful consideration.

Outlet structures for stilling high velocity flows from conduits have taken a variety of forms depending on physical and economic factors of the site and structure. Performance characteristics, general site

adaptability and economic consideration to facilitate judgment in decision between alternate choices is presented. The several design charts eliminate many steps and hours of work for quantity and cost estimating.

Perhaps the most time saving operation in this manual is the summary sheet and procedure for preparing construction drawings. This concluding step opens the door to the several alternatives and considerations in composing a set of construction drawings for gated outlet appurtenances for earth dams.

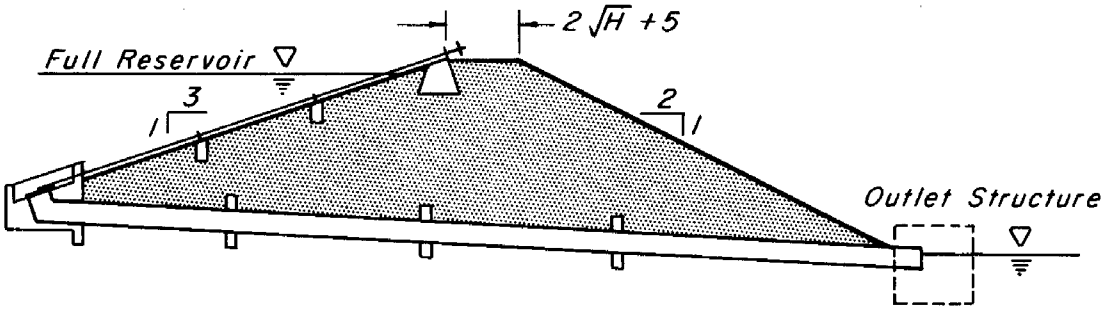
Clarity of construction plans that present the design decisions made in preceding sections of the manual is important. Neatness, legibility and clarity in plans create a psychological response in the builder conducive to better quality work than the response to poorly drafted and vaguely presented details. The ideas offered permit maximum clarity and minimum effort to make a professional presentation of plans, consistent with the quality of design and helpful to both builder and construction engineer in getting a good job done.

It is beyond the scope of this manual to evaluate storage requirements and downstream water needs. In this respect each installation is unique and cannot be standardized. Embankment analysis has also been omitted as a subject requiring individual attention.

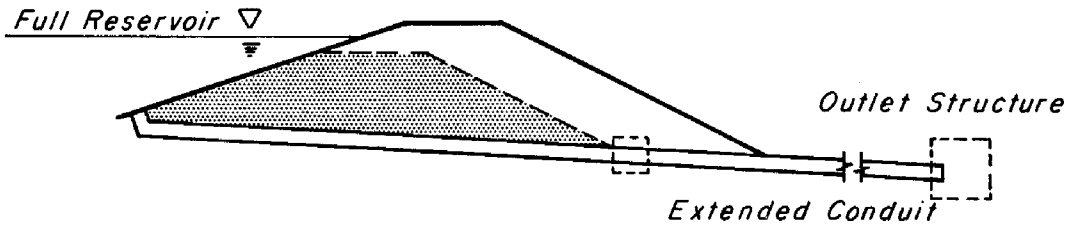
The concept of the STANDARD DAM for purposes of hydraulic design is a basic embankment shape and a full reservoir discharging at the toe of the dam through a conduit. As used in this manual, the cross section of the standard dam consists of an upstream slope of 3:1, a top width * of $2\sqrt{H} + 5$ feet, and a downstream slope of 2:1. The standardized inlet, stem pedestal and lift pedestal are detailed for the 3:1 slope. Hydraulic losses are based on a conduit length associated with the described embankment profile, full reservoir, and a free outfall. Some of the design charts and details are based on this configuration and are not applicable where these conditions are not met. Specific charts where these conditions apply are: Figures B-1, 2, 3, 4; C-4, 5; F-1, 2, 3, 4, 11. If the conduit is extended beyond the toe of the dam, the outlet is submerged or the reservoir only partially full, the hydraulic system, using these figures, should be sized using an EQUIVALENT DAM height. See Figure A-1. The equivalent dam has a fictitious height that makes it equivalent to the standard dam with respect to hydraulic operation.

An overall perspective of the manual content and use is presented in Figure A-2, Procedure Flow Chart. This chart follows the normal sequence in selection and development of the details of gated outlet appurtenances. It shows the major decisions that might affect alternate selection required at various points in the development.

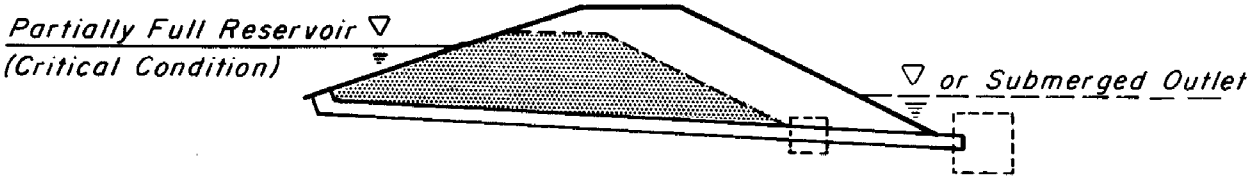
* The difference between this top width compared with one based on $\frac{H + 35}{5}$ will have little effect on the preliminary hydraulic proportioning of the conduit.



STANDARD DAM



EQUIVALENT DAM



EQUIVALENT DAM

FIGURE A-1
STANDARD - EQUIVALENT DAM
EWP Unit Portland Oregon

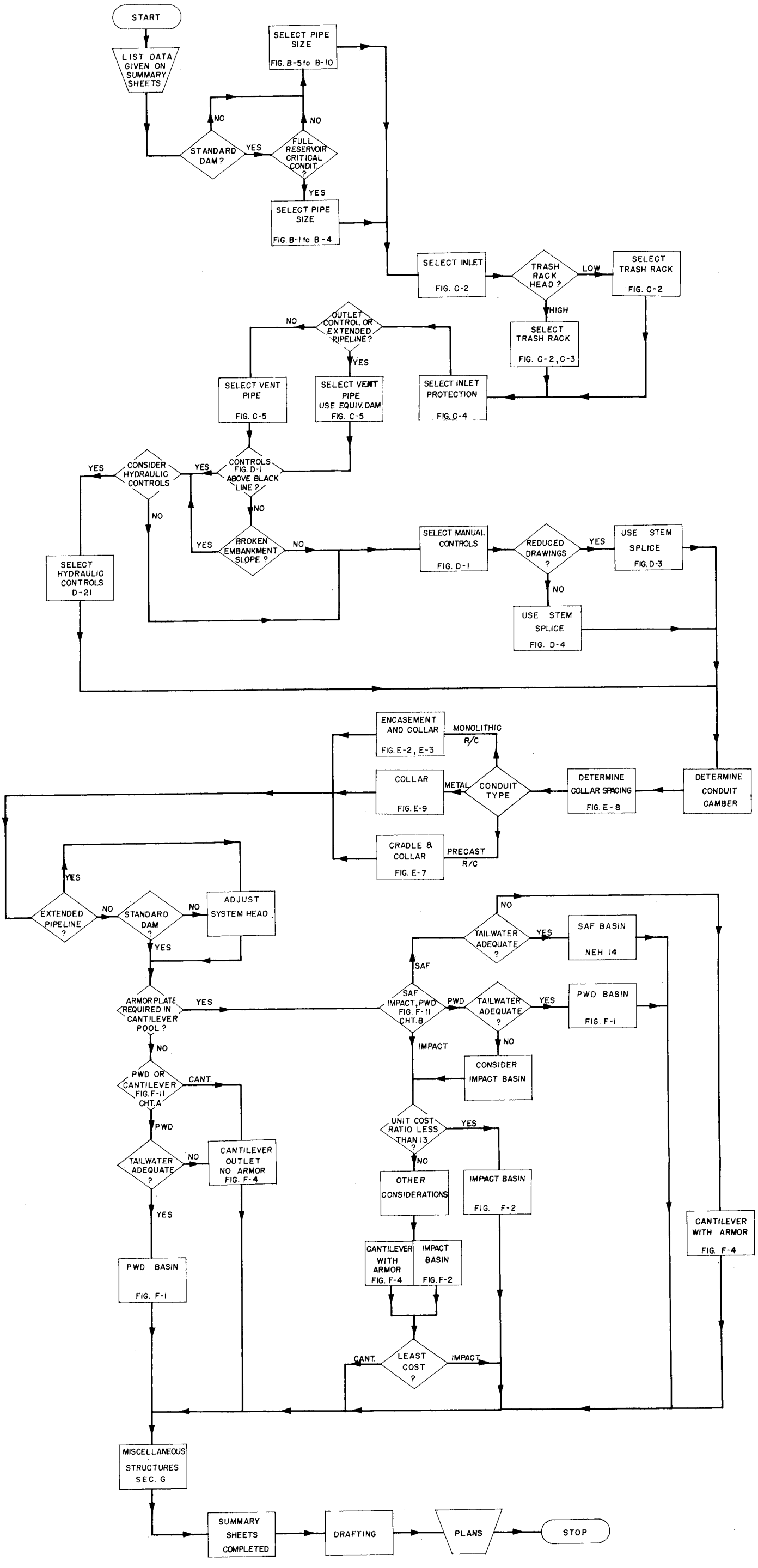


FIGURE A-2

PROCEDURE FLOWCHART

EWP Unit Portland, Oregon